NOTES ON THE SALSA WORKSHOP (28-29 Oct 98)

SALSA WORKSHOP SCHEDULE

--- Wednesday, 28 Oct 98 ---

7:00-8:00 a.m.	Registration	
8:00-8:10	Welcome to Biosphere 2 Center	Graumlich
8:10-8:20	Introduction of Participants	Goodrich/All
8:20-8:30	Workshop Purpose, Objectives, and Schedule	Goodrich/ Chehbouni
8:30-9:00	SALSA Science Plan/Science Challenges	Goff
9:00-10:00	1998 Accomplishments (10-min briefs)	
	- Program Overview	Goodrich
	- Mexico Campaign	Chehbouni
	- Rio Grande ET Study	Cooper
	- Landscape Change	Kepner
	- Outcome of Sierra Vista Meeting	Edmonds
10:00-10:30	BREAK	
10:30-12:00	Open Forum - Breakout Planning	Goff/All
12:00-1:30 p.m.	LUNCH	
1:30-3:30	Breakout Sessions (concurrent)	Groups
	- SALSA Special-Issue	
	- Ecological Studies	
	- Human Dimensions Studies	
	- Remote Sensing/Near-term Activities	
3:30-4:00	BREAK	
4:00-5:00	Breakout Sessions (concurrent)	Groups
5:00-6:00	Adjustment Hour (optional)	
	- Landscape Change Demo	Edmonds
	- Other Demos, Discussions, etc.	TBD
6:00	DINNER (Cookout at Biosphere 2)	All

--- Thursday, 29 Oct 98 ---

8:00-8:30 am	Session Progress/Course Adjustments	Goodrich/All
8:30-10:00	Breakout Sessions (concurrent)	Groups
10:00-10:30	BREAK	
10:30-12:00	SALSA Program Issues	
	- Data Management and Exchange	Goodrich
	- Science Challenges Discussion	Goff/All
	- SALSA Symposium, Hermosillo, 1999	Chehbouni/ Brady
	- Interactions with Other Programs	Shuttleworth

12:00-1:10	LUNCH	
1:10-2:30	New Initiatives/Future Plans (10-min briefs)	
	- Riparian/Groundwater Modeling Studies	Maddock
	- USGS GW-SW Interactions Program	Leake/Webb
	- Transborder WS Res. Program /SP Atlas	Brady/ Edmonds
	- Watershed Modeling	Goodrich
	- Ephemeral Channel Recharge/Isotopes	Williams/Lin
	- Albedo Measurement Project	Pinker
	- MODIS Validation	Huete
2:30-3:30	Final Breakout Sessions (concurrent) - SALSA Special Issue, continued - Water Balance Studies - Others	Groups
3:30-4:00	BREAK	
4:00-5:00	Open Forum - Actions-to-be-Taken	Goodrich/All
5:00-?	Informal Collaboration (optional)	TBD

SALSA WORKSHOP A SUCCESS

About 40 SALSA researchers, from the USA, Mexico, and Europe, participated in the Fall 1998 SALSA Workshop held at Columbia University's Biosphere 2 Center, Oracle, Arizona, 28-29 Oct 98. The objectives of the Workshop were: to encourage collaboration and communication among SALSA scientists; to coordinate publication of research results; to address issues concerning the SALSA Science Plan; and to discuss and plan future SALSA activities. The Workshop was both a technical and social success thanks to the efforts of the Workshop participants and the hospitality our Columbia University hosts, including Dr. Lisa Graumlich, Deputy Director of the Center, and Dr. Guanghui Lin, Biosphere 2 scientist and SALSA collaborator.

SUMMARY OF SALSA WORKSHOP AT BIOSPHERE 2

A list of Workshop participants and more detailed notes will be posted on the SALSA website (http://www.tucson.ars.ag.gov/salsa/salsahome.html) in the coming weeks.

[Note: Although only one name and email addresses is given for each project listed below (for convenience), be aware that there are several other scientists associated with each project or program. Communicate with these contact persons to learn more about a particular project or program.]

PROGRAM OVERVIEW: Dave Goodrich, USDA-ARS (goodrich@tucson.ars.ag.gov) gave a brief overview of the current state of the SALSA program, and outlined completed 1998 activities and activities planned for the future. He also noted that SALSA has been well represented in a variety of international and local conferences over the past year including meetings of the American Meteorological Society, the Ecological Society of America, the American Geophysical Union, and the Arizona Hydrological Society.

SALSA SCIENCE PLAN/SCIENCE CHALLENGES: Bruce Goff, USDA-ARS (bgoff@tucson.ars.ag.gov), described the purpose and nature of the draft Science Plan and requested collaborators to submit information about the science questions and challenges to be addressed by their research.

MEXICO CAMPAIGN: Ghani Chehbouni, ORSTOM-IMADES (ghani@cideson.mx) summarized the outcome of SALSA research activities on the Mexico side of the Upper San Pedro Basin. Researchers from France, Mexico, and the USA conducted a major field campaign this past summer to examine and model surface energy and moisture fluxes (movements) at two study sites near Cananea, Sonora: the grassland (Zapata) site and the mesquite woodland (Riecito) site. The research will increase understanding of the hydrology of the Basin uplands and will aid in validating/calibrating new remote sensing technology.

RIO GRANDE ET STUDY: Dan Cooper, Los Alamos National Laboratory (dcooper@lanl.gov) described a study conducted this past summer to measure evapotranspiration (ET) over a riparian forest at the Bosque del Apache reserve in southern New Mexico. This study applied techniques used during the SALSA 1997 San Pedro Riparian Campaign, combining concurrent measurements of water and energy fluxes (using a "lidar" vapor imaging device, ground-based sensors, and aircraft remote sensing) to estimate ET. The study involved SALSA researchers from LANL, Utah State Univ., Univ. of Iowa, as well as scientists from the US Bureau of Reclamation and New Mexico State Univ.

LANDSCAPE CHANGE: Bill Kepner, EPA Office of Research and Development in Las Vegas, Nevada (Kepner.William@epamail.epa.gov), updated the group on the progress of the EPA-IMADES study designed to determine ecosystem vulnerability relative to large-scale natural or human-induced disturbances using remote sensing, spatial statistics, and geographical information systems (GIS) technology. The spatial data developed for the Upper San Pedro Basin have been used in preliminary analysis of possible land cover changes and are currently being accuracy-assessed.

OUTCOME OF SALSA SEMINAR: Curt Edmonds, EPA Office of Research and Development in Las Vegas, Nevada (Edmonds.Curtis@epamail.epa.gov) recounted the outcome of the SALSA information seminar held in the Sierra Vista City Hall Chambers on 27 Oct 98. Details of this seminar were provided in the 2 Nov 98 San Pedro News email.

SALSA SPECIAL ISSUE: Dave Goodrich led a discussion of what the SALSA collaborators need to do to finalize manuscripts for submission to the Journal of Agricultural and Forest Meteorology by 28 Feb 99. Susan Moran, ARS (moran@tucson.ars.ag.gov) will advise on this effort. The special issue will present results of several SALSA studies from 1996-98.

SALSA SYMPOSIUM, HERMOSILLO, 1999: Ghani Chehbouni sought feedback from the Workshop participants about the proposal to hold a SALSA Symposium in Hermosillo, Sonora, Mexico, in Nov 1999. The multi-day symposium would include sessions on both science and management/policy issues related to the Upper San Pedro Basin. Representatives from federal, state, and local governments, non- governmental organizations, and individuals, from both the US and Mexico sides of the border, would be invited to participate in the meeting. The presentations would be simultaneously translated in both English and Spanish and proceedings would be printed in both languages. Workshop participants supported the proposal and plans are being made to go forward with the symposium. (More news about this at a later date).

DATA MANAGEMENT AND EXCHANGE: Dave Goodrich described the efforts to-date to create a central SALSA database where common data and other information products could be compiled and made readily available to SALSA collaborators. The funding of a database management position is currently the number one priority for the core SALSA effort. Effective and efficient data and information management is critical to the SALSA mission.

INTERACTION WITH OTHER PROGRAMS: Jim Shuttleworth, Univ. of Arizona (shuttle@hwr.arizona.edu) showed how the SALSA effort, which to-date has been primarily of local/regional significance, might in the future play a role in some of the continental and global-scale climate studies currently underway or being developed. These include the GEWEX Continental-Scale International Project (GCIP) (http://www.ogp.noaa.gov/gcip/), CLIVAR (Climate Variability and Predictability) (http://www.clivar.ucar.edu/hp.html), and SuomiNet (http://www.unidata.ucar.edu/suominet/) programs. Climate research in the Upper San Pedro Basin, and Arizona/Sonora in general, can help these larger programs understand the relationship of the American monsoon to global climate patterns. SALSA is well situated to help in this regard.

RIPARIAN ECOSYSTEM STUDIES: Tom Maddock, Univ. of Arizona (maddock@hwr.arizona.edu) described a new Univ. of Arizona/Arizona State Univ. study entitled "Restoring and Maintaining Riparian Ecosystem Integrity in Arid Watersheds." The study area will include the Upper San Pedro Basin. The objectives of the study are to "further community-based environmental protection by integrating hydrologic models, a riparian ecosystem integrity index and economic analyses into a user-friendly decision support system (DSS). Coupled with legal analysis, this integration will assist local governments and stakeholders in understanding the impact of development on the particular watersheds and in evaluating different strategies for achieving environmental restoration from a scientific, economic and legal perspective."

USGS GW-SW INTERACTION STUDY: Stan Leake, USGS (saleake@usgs.gov), presented an overview of a five-year study on interaction of ground water and surface water in the Southwest. The new study is a part of the USGS Ground-Water Resources Program. Stan discussed three examples of water controversies in Arizona where interaction of ground water and surface water is a central theme. The study area presented includes desert basins, the Colorado Plateau, and coastal basins incorporating all or parts of the states of Arizona, California, Colorado, Nevada, New Mexico, and Utah. The study will include components to address (A) regional syntheses of information related to interaction of ground water and surface water, (B) assessments of effects of ground-water development on riparian ecosystems, (C) assessments of effects of climate variations of ground- water recharge and discharge, (D) development of improved methods of quantifying inflow from ground water to streams, and (E) development of improved methods of simulating stream-aquifer interactions. Possible sites for detailed study include the San Pedro River (AZ/Sonora), the Rio Grande (NM), Mojave River (CA), Humbolt River (NV) and many other aquifer systems and riparian systems in the Southwest.

MONITORING STREAMFLOW PATTERNS: Jim Constantz, USGS (jconstan@usgs.gov), provided information about a new study to characterize streamflow dynamics in the San Pedro River. A new technique will be used to estimate patterns of streamflow on the San Pedro. This technique relies on the significantly different pattern of diurnal variations in stream channel temperature for a dry channel compared with a channel possessing streamflow. This technique has been successfully deployed on limited reaches at other locations in the Southwest. A more extensive deployment of temperature monitoring is planned for the San Pedro, possibly extending from Sonora, Mexico north to the Gila River. This study will tie-in to other SALSA hydrology research.

TRANSBORDER WATERSHED RESEARCH PROGRAM/ATLAS: Ward Brady, Arizona State Univ. (ward.brady@asu.edu), updated the Workshop participants on research activities of the Southwest Center for Environmental Research and Policy (SCERP; a government-funded, US-Mexico consortium of universities that study border issues). Researchers in the SCERP Transborder Watershed Research Program are working closely with other SALSA collaborators to develop comprehensive data sets and models of watershed processes in the Upper San Pedro Basin. One outcome of this effort will be the creation of a hardcopy and digital atlas for the USPB that can be used by agencies, organizations, and individuals for analysis and interpretative purposes. The atlas will be in Spanish and English.

WATERSHED MODELING: Dave Goodrich described a new EPA-ARS initiative to develop multi-scale watershed models to assess the interaction of land cover changes and watershed response. The research effort will involve the development of process models using remotely sensed and ground-based data to related landscape composition and pattern to attributes of landscape condition, i.e., water storage and availability, infiltration; surface water quality; erosion; flood frequency, duration, and intensity. Landsat imagery of the SALSA study area and the region, acquired over the past 20 years, will be used in this analysis.

EPHEMERAL CHANNEL RECHARGE/ISOTOPES: Dave Williams, Univ. of Arizona (dgw@ag.Arizona.EDU) provided background information on a new UA-ARS-Cochise County study of ephemeral stream recharge in the Upper San Pedro Basin (on the Walnut Gulch Experimental Watershed near Tombstone). The study will evaluate water use by streamside vegetation, and measured runoff volume, in order to estimate the amount of water entering the groundwater system. The study will also examine the redistribution of water in the soil profile by "leaky" plant roots. Guanghui Lin (glin@bio2.edu) continued the presentation by describing the ongoing UA-Biosphere 2-ORSTOM research on the use of isotopic indicators to assess the relative changes in ET sources from key ecosystems within the Upper San Pedro Basin. This study could offer a method to monitor progressive effects of climate and land use change on carbon and water fluxes at the basin level for semi-arid systems.

ALBEDO MEASUREMENT PROJECT: Rachel Pinker, Univ. of Maryland (pinker@atmos.umd.edu) talked about her SALSA-related albedo (radiant energy reflected by the Earth's surface) measurement research. Albedo information is needed to address problems related to climate trends, hydrologic and biogeophysical modeling, solar energy applications, and agriculture. The UofM Surface Radiation Budget (SRB) Research Group, has been developing methods to infer components of surface radiative fluxes from satellite observations. Rachel is working with other SALSA remote sensing scientists to examine albedo dynamics in the Upper San Pedro Basin. More information about the study can be found at: http://metosrv2.umd.edu/~srb/

EOS/ASTER Program: John Schieldge, Jet Propulsion Laboratory (john@lithos.jpl.nasa.gov) updated the group on the activities of the NASA EOS (Earth Observing System) Advanced Spaceborne Thermal Emission and Reflectance Radiometer (ASTER) program. The ASTER ecosystems and land surface climatology science team is using the San Pedro River Basin as a long-term research site for testing and validation of ASTER algorithms and data products. The ASTER team will work closely with other SALSA researchers to acquire the ground-based data needed to validate the satellite system. John also reported that the ASTER/MODIS airborne simulator, called MASTER, made a successfully overflight of SALSA research areas in the San Pedro Basin (including the riparian corridor, Walnut Gulch, and Audubon Research Ranch) on 18 Sep 98. The SALSA imagery is reported to "look good" and be basically cloud free. Contact John, Dave Goodrich, or Susan Moran for more information about this imagery.

MODIS VALIDATION: Alfredo Huete, Univ. of Arizona (ahuete@ag.arizona.edu), presented information on the ongoing MODIS satellite sensor program. MODIS is a key instrument aboard the EOS AM-1 satellite and is expected to play a key role in the development of Earth system models capable of accurately predicting global change processes. The SALSA San Pedro Basin study area is listed among the core validation test sites for the MODIS satellite sensor.

BREAKOUT SESSIONS:

During the breakout sessions, collaborators were able to meet in smaller groups to discuss issues of particular importance. The following groups met: contact the group leaders for more information about what was discussed.

Remote Sensing Studies: Susan Moran, ARS
Ecological Studies: Bill Kepner, EPA
Surface Flux Studies: Larry Hipps, Utah State Univ. (larry@claret.agsci.usu.edu)
Water Balance Studies: Bob Mac Nish, Univ. of Arizona (macnish@hwr.arizona.edu)

ADDITIONAL STUDIES

The information below describes additional SALSA-related research activities being conducted by SALSA collaborators who could not make it to the Workshop.

ECOLOGICAL HISTORY: Diana Hadley, Univ. of Arizona-Arizona State Museum (hadleyd@u.arizona.edu), sent word that she has received partial-funding for her proposed project "Ecological Change in the Greater Southwest, An Inventory of Baseline Environmental Information in Spanish Colonial Documents." The Ecological Change Project will compile inventories of Spanish Colonial documents (from the Master Index of the Documentary Relations of the Southwest at the ASM) that contain significant ecological information for the northern frontier of New Spain. The Project will collaborate with other SALSA researchers to examine historical environmental change information for the Upper San Pedro Basin. Contact Diana for more information.

RIPARIAN STUDIES: Although Julie Stromberg, Arizona State Univ. (jstrom@imap1.asu.edu) could not make it to the Workshop, she did submit written summaries of five SALSA-related research projects she and her colleagues and students are conducting, including:

a. Development of a Riparian Biotic Integrity Index (component of the Riparian Ecosystems Study noted above). The goal of the project is to develop an index of biotic integrity for Sonoran riparian ecosystems. Data will be collected at the San Pedro River (AZ) and the Kern River (CA) and other Arizona sites.

b. Indicators of Water Stress and Effects of Water Stress on the Biotic Integrity of Fremont Cottonwood Forests and Sacaton Grasslands (part of the Transboundary Watershed Research Program described above). Researchers will examine various types of stress indicators for cottonwood stands and compare these for different reaches along the San Pedro. Researchers will also develop ecological indices for sacaton stands and compare these with site and soil parameters.

c. Ecological Recovery on Abandoned Agricultural Fields Along the San Pedro River. This study will examine the relationships between soil factors and plant community composition within abandoned agricultural fields; how these factors vary along a chronosequence of time-since-abandonment; and whether these relationships can form the basis for prescribing management actions that would hasten the return of riparian communities.

d. Ecology and Restoration of Sacaton Grasslands in Southeastern Arizona. This represents several projects already underway to understand the ecology *of Sporobolus wrightii* grasslands in the San Pedro and nearby basins.

e. Successional Processes in Fremont Cottonwood Forests. This study will compare successional changes in soil and plant communities between stands of Fremont cottonwood and tamarisk, and between free-flowing river sites, regulated river sites, and sites at which biotic factors have been restored.

ECOSYSTEM FRAGMENTATION: Tom Sisk, NAU (Thomas.Sisk@NAU.EDU), also wasn't able to attend the Workshop but he did provide an update on the study "Predicting the Effects of Ecosystem Fragmentation and Restoration: Management Models for Animal Populations." The goal of this study is to develop species-specific models that predict the responses of mobile animal species (specifically birds and butterflies) to natural and human-induced fragmentation in the Upper San Pedro Basin. Using field and remotely sensed data in landscape models, they will compare the impacts of alternative land use strategies on wildlife species of management concern. Tom and his colleagues and grad students will be working closely with other SALSA ecosystem researchers to integrate the this information into an overall understanding of the basin ecosystem.

LIST OF PARTICIPANTS, SALSA WORKSHOP, 28-29 OCT 98

Hector Arias
IMADES
Reyes y Aguascalientes Esq.
Hermosillo, Sonora, Mexico
52 (62) 15-98 61
52 (62) 15-98 64
arias@cideson.mx

Ward Brady
Environmental Resources Program
School of Planning
Arizona State University
Tempe, AZ. 85287-2005
602-965-2402
ward.brady@asu.edu

John Pierre-Brunel
ORSTOM/IMADES
Reyes y Aguascalientes Esq.
Hermosillo, Mexico
(52) 62 10 15 95
brunel@cideson.mx

Manuela Casselmann
Dept. of Educational Geography
Johann Wolfgang Goethe University
Frankfurt, Germany
Schumannstr. 58,
60054 Frankfurt am Guin
520-795-8499
casselmann@em.uni-frankfurt.de

Pascale Cayrol
Centre d'Etudes Spatiales de la
Biosphere, CNES/CESBIO BPI 2801,
18 Ave. E. Belin, 31401, Toulouse,
Cedex 4, FRANCE
pascale.cayrol@cesbio.cnes.fr

Ghani Chehbouni
IMADES/ORSTOM
Reyes y Aguascalientes Esq.
Hermosillo, Sonora, Mexico
52 62 10 15 95
ghani@cideson.mx

Jim Constantz
US Geological Survey
345 Middlefield Rd., MS496
Menlo Park, CA 94025
650-329-4655
jconstan@usgs.gov

Daniel Cooper
Los Alamos Nat. Lab.
Los Alamos, NM 87545
505-665-6501, MS C 300
DCooper@LANL.GOV

Curt Edmunds
EPA/ORD
P.O. Box 93478
Las Vegas, NV 89195-3478
702-798-2264
edmonds.curtis@epamail.epa.gov

Jaime Garatuza
Instituto Tecnológico de Sonora
5 De Febrero, 818 Sur Co.
Obregon, Sonora, 85000 Mexico
52 (64) 17 03 76
52 (64) 17 50 45
garatuza@yaqui.itson.mx

Bruce Goff
USDA-ARS
2000 E. Allen Rd.
Tucson, AZ 85719
520-670-6380 Ext.149
bgoff@tucson.ars.ag.gov

David Goodrich
USDA-ARS
2000 E. Allen Rd.
Tucson, AZ 85719
520-670-6380 Ext.175
goodrich@tucson.ars.ag.gov

Lisa Graumlich
Earth Learning Center
Columbia University
Biosphere 2 Center
P.O. Box 689
Oracle, AZ 85623
520-896-5016
Lgraumlich@bio2.edu

Haydee Hampton
US Geological Survey
2255 N. Gemini Dr.
Flagstaff, AZ 86001
520-556-7164
hmhampton@usgs.gov

Lawrence Hipps
Plants, Soils & Biometeorology
Utah State University
Logan, UT 84322-4820
435-797-2009
larry@clarert.Agsci.usu.Edu

Alfredo Huete
Department of Soil, Water &
Environmental Science
University of Arizona
Tucson, AZ 85721
520-621-3228
ahuete@ag.arizona.edu

Jesse Juen
Bureau of Land Management
12661 E. Broadway
Tucson, AZ 85748
520-722-4289
jjuen@az.blm.gov

Bill Kepner
EPA/ORD
P.O. Box 93478
Las Vegas, NV 89191-3478
702-798-2193
kepner.william@epamail.epa.gov

Laurent Kergoat
Centre d'Etudes Spatiales de la
Biosphere, CNES/CESBIO BPI 2801,
18 Ave. E. Belin, 31401, Toulouse,
Cedex 4, FRANCE
kergoat.let@cesbio.cnes.fr

Alice Konieczki
US Geological Survey
520 N. Park Ave., Suite 221
Tucson, AZ 85719
520-670-6671 Ext. 270
alicek@usgs.gov

Stan Leake
US Geological Survey
520 N. Park Ave., Suite 221
Tucson, AZ 85719
520-670-6671 Ext. 259
saleake@usgs.gov

Guanghui Lin
Columbia University
Biosphere 2 Center
32540 S. Biosphere Road
P.O. Box 689
Oracle, AZ 85623
520-896-6478
glin@bio2.edu

Bob Mac Nish
Dept. of Hydrology and Water Resources
320 A Harshbarger
University of Arizona
Tucson, AZ 85721
520-621-3041
macnish@hwr.arizona.edu

Bruno Monteny
ORSTOM
DICTUS-University of Sonora
Hermosillo, Sonora, Mexico
52 62 11 22 36
monteny@imparcial.com.mx

Susan Moran
USDA-ARS
2000 E. Allen Rd.
Tucson, AZ 85719
520-670-6380 Ext.171
moran@tucson.ars.ag.gov

Ivan Parra
IMADES
Reyes y Aguascalientes Exq.
Hermosillo, Sonora, Mexico
52 (62) 15 98 61
52 (62) 15 98 64
ivan@cideson.mx

Rachel Pinker
Dept. of Meteorology
University of MD
College Park, MD 20772
301-405-5380
pinker@atmas.umd.edu

Don Pool
US Geological Survey, WRD
520 N. Park Ave.
Tucson, AZ 85719
520-670-6671 Ext. 258
drpool@usgs.gov

Leslie Ries
Northern Arizona University
Environmental Sciences
P.O. Box 5694
Flagstaff, AZ 86001
520-523-7839
leslie.Ries@nau.edu

Julio Cesar Rodriquez
Instituto Tecnologico de Sonora
Reyes y Aguascalientes, Esq.
Col. San Benito
Hermosillo, Mexico
52 (62) 10 15 95
JCROD@cideson.mx

John Schieldge
Jet Propulsion Laboratory
Terrestrial Science Element
MS 183-501
4800 Oak Grove Dr.
Pasadena, CA 91109
818-354-9879
john@lithos.jpl.nasa.gov

Russ Scott
Dept. of Hydrology & Water Resources
University of Arizona
Tucson, AZ 85721
520-621-1379
520-670-6380 Ext. 159
russell@tucson.ars.ag.gov

Jim Shuttleworth
Dept. of Hydrology & Water Resources
Harshbarger Bldg. 11
University of Arizona
Tucson, AZ 85721
520-621-8787
shuttle@hwr.arizona.edu

Jim Simpson
Columbia University
Geochemistry
Lamont Doherly Earth Observatory,
Palisades, NY 10964
914-365-8570
simpsonj@ldeo.columbia.edu

Jim Toth
Dept. of Hydrology & Water Resources
University of Arizona
Tucson, AZ 85721
520-621-1985
toth@hwr.arizona.edu

Chris Watts
IMADES
Reyes y Aguascalientes, Esq.
Hermosillo, Sonora, Mexico 83190
52 62 10 15 95
watts@cideson.mx

Dave Williams
School of Renewable
Natural Resources, BSE 325
University of Arizona
Tucson, AZ 85721
520-670-7289
dgw@ag.arizona.edu

Ismail Yucel
Dept. of Hydrology &
Water Resources
University of Arizona
Tucson, AZ 85721
520-621-1378
yucel@hwr.arizona.edu